brief report

Car tire injuries: a review of 35 patients

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With the increasing number of road traffic accidents, a new type of pedestrian injury has emerged that is described as a "car tire injury".[1,2] Most of the victims of this type of accident are children. The main reason behind such injuries is reckless driving and drivers who are younger than the legal age. The main objective of this study was to shed light on this problem, which has received little attention as evidenced from the literature, as only two papers have been published.[1,2]

PATIENTS AND METHODS

During the period from October 2001 to March 2007 (66 months), 35 patients, all pedestrians, were treated for injury to the foot and ankle due to road traffic accidents. Patients were treated initially in the emergency department at the time of injury as is routinely done for all victims of accidents and trauma, to stabilize them before definitive repair of their injuries. The types of injuries share common features and are grouped in a distinct entity known as "car tire injuries". The details of patients studied were retrieved from their medical records. The same surgeon did all operations. Pictures of the patients were taken with the permission of the patients and their parents.

Table 1. Age of patients (n=35).

Age group (years)	Male (%)	Female (%)	Total (%)
3 to 6	16 (45.7)	6 (17.1)	22 (62.8)
7 to 10	8 (22.8)	3 (8.6)	11 (31.4)
Adults	1(2.9%)	1 (2.9%)	2 (5.8%)
Total	**25 (71.4)**	**10 (28.6)**	**35 (100)**

Table 2. Affected site in 35 car tire injuries.

	Right foot (%)	Left foot (%)	Total (%)
Dorsum	25 (71.4%)	3 (8.6%)	28 (80.0%)
Medial malleolus	4 (11.4%)	0	4 (11.4%)
Lateral malleolus	0	3 (8.6)	3 (8.6%)
Associated fractures	1 (2.9%)	1 (2.9%)	2 (5.8%)

RESULTS

From October 2001 to March 2007, 35 patients with injuries to their feet and ankles were treated in our unit. Thirty-three (94.3%) of these 35 were children younger than 10 years of age (Table 1). Only two patients were adults (5.7%). Males were affected more often than females; the male-female ratio was 2.5:1 (25 males, 10 females). The dorsal part of the right foot was involved in 25 (71.4%) patients, and the dorsal part of the left foot in 3 (8.6%) cases. In 4 (11.4%) patients, the medial malleolus was affected; the lateral malleolus was involved in another 3 (8.6%) patients (Table 2). Fifteen (42.9%) patients were treated with a dressing only. Seven cases (20%) that were more severe were skin grafted, and the remaining 13 (37.1%) were treated using an adipofascial flap plus a skin graft. According to the classification of such injuries described by Al-Qattan, 15 (42.9%) patients were grade 1 (Figure 1); 4 (11.4%) patients were grade 2; 3 (8.6%) patients were grade 3; 11 (31.4%) patients were grade 4, and 2 (5.7%) patients were grade 5 (Figure 2) (Table 3).

All patients showed full recovery without residual disability, and only 8 developed complications like wound infection in 3 (8.6%), and hypertrophic scars in 5 (14.3%) patients.

DISCUSSION

Road traffic accidents are a major cause of injury and death among young people in Saudi Arabia, and indeed in many other countries, where children are allowed to play in the street.[1,2] As reported by Al-Qattan,[1] and Nuzumalali et al,[2] the term "car tire injury" of the foot is now well recognized. We report our experience with such injuries in 35 patients. To our knowledge, this is the second full epidemiological review of this kind of injury, the first being that of Al-Qattan. Our study was retrospective while his study was prospective. The mechanism of car tire injuries is well described.[1,2] The victim is always a pedestrian, usually a child, who while

Table 3. Classification of the severity of foot injury in the 35 patients.

Severity grade	Right foot (%)	Left foot (%)	Total (%)
Grade 1: superficial second-degree friction burns without skin loss	12 (34.3%)	3 (8.6%)	15 (42.9%)
Grade 2: deep second-degree friction burns with a small area of skin loss	3 (8.6 %)	1 (2.9%)	4 (11.4%)
Grade 3: third-degree friction burns with or without a small area of skin loss	2 (5.7%)	1 (2.9%)	3 (8.6%)
Grade 4: skin avulsion with tendon and/or bone exposure	10 (28.5%)	1 (2.9%)	11 (31.4%)
Grade 5: severe soft tissue injury with significant bone loss	1(2.9)	1 (2.9)	2 (5.7%)
Total	**28 (80%)**	**7 (20%)**	**35 (100%)**

trying to escape from the car, gets his foot caught under the car tire when the driver is trying to stop the car. The resultant injury is due to a combination of friction burns, crushing, shearing, and degloving.[1] Untreated, these injuries can result in a considerable disability from severe contracture. These injuries have been classified into 5 grades (Table 3) according to the severity of the injury and magnitude of tissue damage.[1] Most of our patients were children (Table 1), which is similar to findings in other studies.[1] This is understandable as children are in the streets more often than adults, and playing unattended, especially in developing countries.[1] Males are affected more than females, most probably because male children are usually more active and tend to play outdoors more than female children. Al-Qattan's study showed similar results.[1] As reported in other studies,[1-3] we found that the dorsal aspect of the foot was the most affected part, followed by the medial malleolus area and the lateral malleolus. Our study showed that the right foot was affected more than the left, possibly because the right foot is dominant in most people and the foot first put forward to pivot and turn when trying to escape and the one left behind at the time of impact.

There was an associated fracture in two patients in whom the distal part of the tibia was fractured. Fujita et al[3] studied associated tibial fractures in 15 patients and found that the middle third of the bone was the most affected. However, his cases also included injuries due to road traffic accidents in nonpedestrians.[3] All patients with grade 1 injury in our study were treated expectantly as they were superficial friction burns. Seven (20.0%) patients with grade 2 and 3 injuries were debrided and grafted using a split-thickness skin graft. As reported by Fujita et al,[3] we found that a split-thickness skin graft was successful when applied immediately or as a delayed procedure when the wound was infected or heavily contaminated, even when there were exposed ligaments,

Figure 1. Grade 1 car tire injury.

Figure 2. Grade 5 car tire injury.

which were covered with granulation during the delay time. However, the draw back of a split-skin graft is that it tends to contract later on, and will not allow full excursion of the underlying tendons.[3] Thirteen (37.1%) patients in whom the injury was deep (grade 4 and 5) were treated using a local distally based adipofascial flap with a full-thickness skin graft. We think this is the ideal method for covering such deep wounds[5,6] with exposed tendons or bones as it provides the least bulk, unlike other known methods, such as fasciocutaneous flaps,[1] or free flaps,[2,8] which results in a bulky flap that disturbs the countering of the foot and makes it difficult for the patient to wear shoes.[4,9,10] We encountered 3 (8.6%) cases of wound infection treated successfully with antibiotics, and in 5 (14.3%) patients the grafts were complicated later by a hypertrophic scar. The relatively high rate of infection was due to the fact that some of the patients' relatives were reluctant to agree to surgery, thus delaying wound coverage. Some patients actually refused surgery only to come back later with severe foot contracture, requiring more complicated procedures.

Car tire injuries seem to be increasing because children are left to play in the roads when they should play in protected playgrounds away from cars. Further studies are needed to identify the key factors that cause these injuries in order to minimize or eliminate them.

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